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Iatrogenic Axillary Pseudoaneurysm Caused by Ultrasound-guided, Vacuum-assisted Biopsy of the Axillary Lymph Node: A Case Report

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Abstract: Arterial pseudoaneurysms are contained ruptures of the arterial wall that require prompt intervention. Iatrogenic pseudoaneurysms may result from various diagnostic and therapeutic procedures. Iatrogenic axillary pseudoaneurysms are quite rare, with few reported cases in the literature. We report a case of a 45-year-old woman who sustained an axillary pseudoaneurysm after an ultrasound-guided, vacuum-assisted biopsy of the axillary lymph node. An arteriovenous fistula developed concomitantly. Despite two image-guided treatments, thrombin injection and endovascular coil embolization, the pseudoaneurysm had persistent flow and was ultimately surgically resected at the time when the patient underwent mastectomy for breast cancer.

Keywords: *iatrogenic, axillary, pseudoaneurysm, biopsy*

Introduction

A pseudoaneurysm, also known as a false aneurysm, is a lesion secondary to a vessel wall injury where the blood leaks through the wall but is contained by the adventitia or surrounding soft tissue. Pseudoaneurysms are potentially life threatening[1] and should be promptly diagnosed and treated. While pseudoaneurysms may begin as silent lesions, they can lead to complications, such as hemorrhage, infection, distal embolization, ischemia, and nerve damage.[2]

The causes of pseudoaneurysms vary, including penetrating or blunt trauma, infection, inflammation, and iatrogenic injury.[2] The estimated incidence of pseudoaneurysm as a complication of all diagnostic and therapeutic procedures[1] is approximately 1-7.7%. Because the femoral artery is routinely used as an arterial access for endovascular procedures, it is by far the most common site of iatrogenic pseudoaneurysm formation.[3] Management approaches for the femoral artery pseudoaneurysms have been well described. Minimally invasive interventions, including percutaneous thrombin injection and covered stent placement, are the standard of care.[2]

Key Points

- Arterial pseudoaneurysms are contained ruptures of the arterial wall that require prompt intervention.
- Color-Doppler ultrasound, the first-line imaging modality for diagnosing pseudoaneurysms, shows a characteristic yin-yang sign of blood swirling within the aneurysmal sac.
- Minimally invasive interventions, including percutaneous thrombin injection and covered stent placement, are the standard of care for the treatment of pseudoaneurysms.

There is a paucity of literature on the treatment of axillary pseudoaneurysms, which comprise less than 2% of pseudoaneurysms.[4] Axillary pseudoaneurysms are often associated with traumas, such as anterior shoulder dislocations, proximal humeral fractures, and stab or gunshot wounds.[3] Rarely, iatrogenic causes of pseudoaneurysms have been reported, including pacemaker placement and coronary angiography via brachial artery access.[4] One case report documented an axillary pseudoaneurysm after a core needle biopsy of the axillary lymph node.[5] According to the report, the biopsy was performed with an ultrasound-guided, 14-gauge, semi-automatic biopsy device. A 2-cm pseudoaneurysm that was found on ultrasonograms and computed tomography angiograms (CTA) was surgically resected.[5]

Here, we describe a case of an iatrogenic axillary pseudoaneurysm developed after an ultrasound-guided, vacuum-assisted biopsy of the axillary lymph node. The pseudoaneurysm was initially treated with endovascular coil embolization and direct thrombin injection but ultimately required surgical resection.

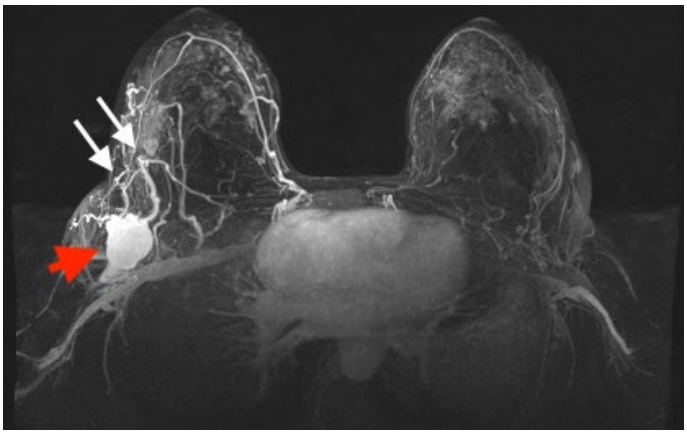
Case

A 45-year-old woman recently diagnosed with an invasive ductal carcinoma of the right breast and metastases to the right axilla presented to our institution for further medical care. The patient had undergone biopsies of a right breast mass and the right axillary lymph node at an outside facility. An ultrasound-guided, vacuum-assisted 12-gauge breast biopsy device (ATEC; Hologic Inc) had been used to take six cores of tissue from each of the sites.

Magnetic resonance imaging (MRI) and contrast-enhanced positron emission tomography/computed tomography (PET/CT) of the breast were performed at our institution to evaluate the extent of the breast cancer. Both studies showed a 3.2-cm homogeneously enhancing right axillary mass adjacent to a biopsy marker and connected to arterial feeding vessels; the structure consistent with a postbiopsy pseudoaneurysm (Figure 1A, 1B). An arterial duplex ultrasound of upper extremity confirmed a 3.3-cm pseudoaneurysm arising from the branches of the right axillary artery (Figure 2A, 2B). Clinically, the patient had pain without evidence of compromised neurovascular status secondary to the pseudoaneurysm.

Figure 1. MR and CT images of a Patient with Breast Cancer after a Recent Axillary Lymph Node Biopsy.

A MRI axial maximum intensity projection



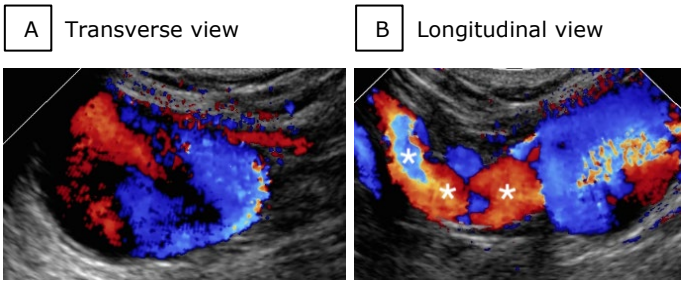
B CT coronal view

A contrast-enhanced MRI of the breast, axial maximum intensity projection (MIP) (A), shows a homogeneously enhancing right axillary mass (A, red arrow) measuring 32 x 21 x 30 mm at the site of a prior biopsy. Two arterial feeders are present (A, white arrows). A contrast-enhanced CT of the chest, coronal view (B), shows a homogenously enhancing mass within the right axilla (B, red arrow) with enhancement characteristics consistent with arterial blood pool and feeding arterial vessels (B, white arrow). The findings are compatible with a postbiopsy pseudoaneurysm.

The patient underwent a right upper extremity angiography that showed the pseudoaneurysm with two arterial feeders from the axillary artery

and a prominent draining vein, suggesting presence of an arteriovenous fistula (Figure 3A). Coil embolization of the two arterial feeders was performed (Figure 3B), but persistent contrast filling arising from collaterals was seen in the pseudoaneurysm sac. Using ultrasound guidance, thrombin was injected percutaneously into the pseudoaneurysm with simultaneous manual compression of the venous outflow. Postinjection ultrasound showed stasis and clot within the pseudoaneurysm.

Figure 2. Arterial Duplex Ultrasound of the Axilla of a 45-year-old Woman after a Recent Axillary Lymph Node Biopsy.



A 3.3-cm lesion arising from the branches of the right axillary artery with a characteristic yin-yang sign (A) and the adjacent arterial feeders (B, asterisks) on color-Doppler ultrasonograms suggests the presence of a pseudoaneurysm.

Follow-up ultrasound, eight days later, showed recurrence of flow in the pseudoaneurysm. Therefore, the patient returned to the interventional suite where venography of the right axillary vein was performed followed by coil embolization of the pseudoaneurysm sac via the venous outflow tract (Figure 3C, 3D). A second ultrasound-guided percutaneous injection of thrombin was performed until complete thrombosis within the pseudoaneurysm was achieved. A follow-up ultrasound, six days later, confirmed continued occlusion.

However, a follow-up chest CTA, three weeks later, showed a persistent hyperdensity representing residual flow along the margin of the pseudoaneurysm sac (Figure 4). After completion of neoadjuvant chemotherapy, the patient underwent bilateral mastectomy and a sentinel lymph node biopsy. At that time, the pseudoaneurysm was clamped, ligated, and completely resected at the site of the previously placed embolization coil. The remainder of the surgery was uneventful. Histologic examination subsequently confirmed pseudoaneurysm and absence of metastases in the adjacent lymph nodes.

The patient has been without complications or recurrence of the disease for more than two years.

Discussion

Vacuum-assisted biopsy systems are designed to suction breast tissue into a sampling chamber so that the rotating cutting device can continue taking samples. Vacuum-assisted stereotactic breast biopsies are the standard of care because, compared with core needle biopsies, they yield superior in volume and quality tissue samples and result in greater accuracy of histologic diagnosis.[6] Recently, vacuum-assisted breast biopsies with ultrasound guidance have become available for clinical use. While the efficacy of these biopsies has been relatively less studied, the rates of missed cancers and underestimation appear comparable to those of core needle biopsies.[6]

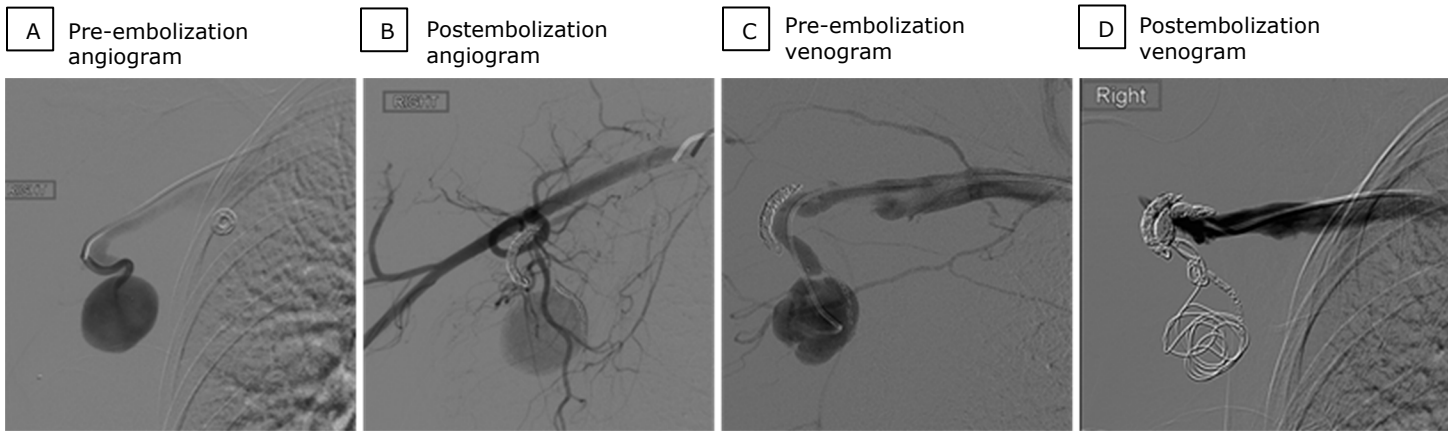
The main complication associated with the use of vacuum assistance in biopsies is bleeding. Simon et al[6] observed that 7% (5/71) of vacuum-assisted ultrasound-guided breast biopsies resulted in prolonged bleeding, where hemostasis was achieved with additional compression in all cases. The authors posited that ultrasound-guided procedures might have a slightly higher risk of bleeding because of the lack of breast compression during biopsy, compared with stereotactic procedures where breast compression is constant. A randomized study by Maxwell et al[7] showed that vacuum-assisted, ultrasound-guided axillary lymph node biopsies in women with breast cancer were associated with more postprocedural pain, and 2/40 patients developed hematomas, compared with none in the core-needle-biopsy group.

It seems likely that because of the rarity of pseudoaneurysms, they were not specifically identified as complications in these studies. On imaging, a pseudoaneurysm should be differentiated from a hematoma, given that the latter is a much more common postbiopsy complication that can also enhance.[8] However, the main differentiating feature of a hematoma is the

lack of feeding vessels. Accurate identification of pseudoaneurysms and prompt intervention are imperative because these lesions can lead to serious complications.

Color-Doppler ultrasonography is considered the first-line imaging modality for diagnosing superficial pseudoaneurysms.[2] The yin-yang sign of blood swirling within the aneurysmal sac on

Figure 3. Embolization of the Axillary Pseudoaneurysm in a 45-year-old Woman.



Pre-embolization digital subtraction angiogram with contrast injection into the right axillary artery (A) confirms the presence of a pseudoaneurysm. After coil embolization of two arterial feeders, there is persistent filling of the pseudoaneurysm (B). Percutaneous direct thrombin injection was subsequently performed under ultrasound guidance. Because of the recurrence of flow in the pseudoaneurysm on follow-up ultrasound, the patient returned to the interventional suite. Pre-embolization venogram of the right axillary vein (C) shows persistent filling of the pseudoaneurysm. Coils were deployed to partially pack the pseudoaneurysm and to completely obstruct the venous outflow (D). No retrograde flow into the pseudoaneurysm is seen.

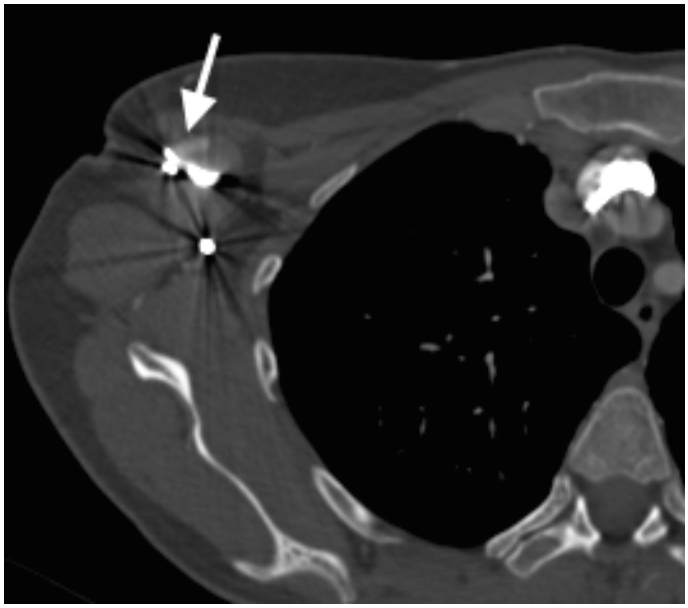
color-Doppler ultrasonograms and the bidirectional flow on pulse-wave Doppler ultrasonograms are the hallmark findings.[2] Ultrasound has high sensitivity (94%) and specificity (97%) for the diagnosis of iatrogenic pseudoaneurysms.[1] CTA can be an additional diagnostic imaging modality that allows better detection of origin of the lesion and its relationship with the surrounding structures.[5] CTA is especially useful for planning endovascular treatment of pseudoaneurysms. It is also helpful in the diagnosis of acute arterial bleeding from a ruptured pseudoaneurysm, which manifests as arterial contrast extravasation that persists on a more delayed scan.[2] MRA is less utilized in the diagnosis of pseudoaneurysms because of higher cost and lesser availability but can yield diagnostic information similar to that of CTA.[2]

Conventional angiography is considered the diagnostic gold standard for detection of pseudoaneurysms and their concurrent treatment when warranted. Image-guided minimally invasive interventions generally have lower rates of complications than open surgery.[9] Ultrasound-guided direct percutaneous injection of thrombin is considered the first-line technique for treating pseudoaneurysms,[9] with success rates close to 97%. Thrombin rapidly induces thrombus formation within the pseudoaneurysm. This method is recommended for pseudoaneurysms with a narrow sac neck of <10 mm.[10] This is because of the potential serious complication, distal embolization by thrombin escaping through the pseudoaneurysm neck into the parent artery; the event occurring in up to 0.8% of cases.[10] Carratola et al[3] reported a case of successful treatment of a traumatic axillary pseudoaneurysm with percutaneous thrombin injection and intravascular balloon occlusion. This technique is useful for the treatment of wide-necked pseudoaneurysms because the balloon occlusion of the artery helps to prevent distal embolization.

Transcatheter arterial embolization is another approach to minimally invasive treatment of pseudoaneurysms. It can be performed with different embolization materials and devices, including coils, glue, or vascular plugs. The typical approach is to embolize the parent artery on either side ("front and back door" embolization) of the pseudoaneurysm neck to completely exclude the

pseudoaneurysm.[2] However, this is not advisable in critical vascular territories because of a possible occlusion of distal flow.[2] Coil embolization of the pseudoaneurysm sac alone is typically not sufficient because the sac is composed of only adventitia and can continue to enlarge.[11] Covered stent placement is yet another potential approach, but it should be employed with caution at the sites of flexion and arterial branches.[2] In our patient, a combined approach of coil embolization and thrombin injection was used, but the presence of multiple collateral arteries supplying the sac resulted in later reperfusion.

Figure 4. CTA of the Chest 3 Weeks after Embolization of an Axillary Pseudoaneurysm in a 45-year-old Woman.



A small focus of hyperdensity along the pseudoaneurysm sac (arrow) represents residual flow.

As in this case, it is not uncommon for a pseudoaneurysm to coexist with an arteriovenous fistula characterized by direct communication between arterial feeders and draining veins.[2] A combination of endovascular techniques may be used to achieve occlusion of both a pseudoaneurysm and arteriovenous fistulas. For instance, one case report described a successful percutaneous thrombin injection of a femoral artery pseudoaneurysm while simultaneously occluding the venous outflow of a communicating arteriovenous fistula with a balloon.[12]

Surgical treatment, while being largely replaced by less invasive image-guided interventions, is still preferred in cases of rapidly enlarging pseudoaneurysms, especially in the presence of hemodynamic instability, distal ischemia or neuropathy, impending compartment syndrome, infection, or failed image-guided intervention.[2] Evacuation of hematoma followed by suturing or patch angioplasty of the damaged arterial wall is a common surgical approach for pseudoaneurysm repair.[2]

Follow-up imaging with color-Doppler ultrasound or CT is important for assessing the treatment success, as illustrated in our case report. Some authors advocate performing follow-up imaging one day after intervention, while others prefer more delayed follow-up, 7-10 days after intervention.[2] Our case demonstrated that performing follow-up weeks after an intervention can be helpful as well, as delayed recanalization can occur.

Author Contributions

Conceptualization, S.A.LF., J.P.M., and S.L.; Acquisition, analysis, interpretation of data, and writing – original draft preparation, S.L.; Review and editing, S.A.LF. and J.P.M.; Supervision, S.A.LF. All authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. All authors had full access to all the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.

Disclosures

None to report.

References

1. Saad NEA, Saad WEA, Davies MG, Waldman DL, Fultz PJ, Rubens DJ. Pseudoaneurysms and the role of minimally invasive techniques in their management. *Radiographics*. 2005;Suppl 1:S173-189. DOI: 10.1148/rg.25si055503
2. Keeling AN, McGrath FP, Lee MJ. Interventional radiology in the diagnosis, management, and follow-up of pseudoaneurysms. *Cardiovasc Intervent Radiol.* 2009;32(1):2–18. DOI: 10.1007/s00270-008-9440-3
3. Carratola M, Parikh P, Tchorz K, Kauffman S. Traumatic axillary artery pseudoaneurysm treated with intravascular balloon occlusion and percutaneous thrombin injection. *Radiol Case Rep.* 2015;9(1):e00031. Published 2015 Dec 7. DOI: 10.2484/rcr.v9i1.871

4. Szendro G, Golcman L, Klimov A, et al. Arterial false aneurysms and their modern management. *Isr Med Assoc J*. 2001;3(1):5–8.
5. Vignoli C, Bicchierai G, Masciotra MC, et al. Axillary pseudoaneurysm post core needle biopsy. *Breast J*. 2019;25(5):980–983. DOI: 10.1111/tbj.13381
6. Simon JR, Kalbhen CL, Cooper RA, Flisak ME. Accuracy and complication rates of US guided vacuum-assisted core breast biopsy: initial results. *Radiology*. 2000; 215(3):694-697. DOI: 10.1148/radiology.215.3.r00jn37694
7. Maxwell AJ, Bundred NJ, Harvey J, Hunt R, Morris J, Lim YY. A randomised pilot study comparing 13 G vacuum-assisted biopsy and conventional 14 G core needle biopsy of axillary lymph nodes in women with breast cancer. *Clin Radiol*. 2016;71(6):551-557. DOI: 10.1016/j.crad.2016.02.024
8. Dixon AM, Enion DS. Pseudoaneurysm of the breast: case study and review of literature. *Br J Radiol*. 2004;77(920):694-697. DOI: 10.1259/bjr/55440225
9. Shah KJ, Halaharvi DR, Franz RW, Jenkins J. Treatment of iatrogenic pseudoaneurysms using ultrasound-guided thrombin injection over a 5-year period. *Int J Angiol*. 2011;20(4):235-242. DOI: 10.1055/s-0031-1295521
10. Krueger K, Zaehringer M, Strohe D, Stuetzer H, Boecker J, Lackner K. Postcatheterization pseudoaneurysm: Results of US-guided percutaneous thrombin injection in 240 patients. *Radiology*. 2005;236(3):1104-1110. DOI: 10.1148/radiol.2363040736
11. Morgan R, Belli AM. Current treatment methods for postcatheterization pseudoaneurysms. *J Vasc Interv Radiol*. 2003;14(6):697-710. DOI: 10.1097/01.rvi.0000071089.76348.6a
12. Mittleider D, Cicuto K, Dykes T. Percutaneous thrombin injection of a femoral artery pseudoaneurysm with simultaneous venous balloon occlusion of a communicating arteriovenous fistula. *Cardiovasc Intervent Radiol*. 2008;31 Suppl 2:S115-S119. DOI: 10.1007/s00270-007-9200-9